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# REPORT OF THE JOINT WORKSHOP OF THE ICES-FAO WORKING GROUP ON FISHING TECHNOLOGY AND FISH BEHAVIOUR [WGFTFB] AND THE WORKING GROUP ON FISHERIES ACOUSTICS SCIENCE AND TECHNOLOGY [WGFAST] (JFATB)

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DUBLIN, IRELAND

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# Contents

# 1 Executive summary

Optical and acoustic technologies are increasingly viable techniques for studies of fish behaviour for the purposes of quantifying catchability. The requirement for eco-system-based approaches to fisheries management also means a move towards using a suite of sampling tools, including acoustics and optics, to collect information not just on the target species, but also the wider community and their habitat, as well as the impact of fishing and other activities on the environment. However, the use of these techniques, especially in combination, brings new challenges in handling, synchronising and analysing large amounts of data. A Joint FTFB/FAST Workshop was convened to consider new and innovative usage of acoustic and optical instruments and computer simulation to monitor and/or estimate fish behaviour, catchability and bottom habitats. The eight presentations covered a range of applications; abundance estimation, habitat mapping, novel techniques for quantification of catchability and the physical impact of trawl components and advances in integrating multiple data sets and automation of fish identification. A number of themes were identified; trawls, acoustic and video systems all have different resolutions and capabilities that are complimentary. The strength and challenge is in combining these different tools for a greater resolution, over a wider area allowing a more holistic view of the eco-system. To do so, practical and accurate referencing of data in space and time is crucial. If this is achieved, then the potential rewards of visualization, exploration and analysis of these multiple data sets in a 4D computerized environment are enormous. A very clear need still exists for a range of effective image processing tools that allow analysis to be automated to some degree and reduce the data bottleneck. Advances in this area are being made. Ideally these applications will be simple, functional and cheap. The reality is that such applications often, though not always, require specialized expertise and a large amount of development time. As such there is still a lot of value that can be gained from straight-forward experiments using optical techniques which require only simple scoring of data.

# 2 Introduction

## 2.1 Background

Understanding selectivity and catchability and the influence of fish behaviour on those processes is required to improve characterization of uncertainties associated with trawl surveys and trawl sampling for acoustic surveys. Optical and acoustic technologies are increasingly viable techniques for quantifying catchability and selectivity and studies of fish behaviour. The requirement for eco-system-based approaches to fisheries management also means a move towards using a suite of sampling tools to collect information not just on the target species, but also the wider community and their habitat, as well as the impact of fishing and other activities on the environment. However, the use of optical and acoustic techniques especially in combination brings new challenges in handling, synchronising and analysing large amounts of data. The aim of the Joint Workshop was to showcase and discuss recent advances in the use of optical and acoustic technologies within the two groups.

## 2.2 Terms of Reference

In response to the ICES Resolution of the 92nd Statutory Meeting, a Joint Workshop of the ICES_FAO Working group on Fishing Technology and Fish Behaviour and the Working Group on Fisheries Acoustics Science and Technology (WGFAST) (Co-Chairs: Emma Jones, Scotland and Eirik Tenningen, Norway; and Rapporteur: Dave Reid, Scotland) met in Dublin, Ireland on the 25th April to:

a ) consider new and innovative usage of acoustic and optical instruments and computer simulation to monitor and/or estimate fish behaviour, catchability and bottom habitats.

## 2.3 Participants List

A list of participants appears in Annex 1

# 3 Presentations

## 3.1 Optically-assisted Acoustic Survey Technique (COAST) for surveying rockfish in the Southern California Bight.

**David A. Demer[1], John L. Butler[1], Deanna R. Pinkard[1], and Ken Franke[2]**

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The stocks of lingcod and six rockfish species, including four that are important to California anglers and commercial fishermen (bocaccio, canary rockfish, widow rockfish and cowcod), are estimated at or below 25% of their pristine levels, and have been declared over fished by the Pacific Fisheries Management Council. In response to this potential ecologic and economic disaster, two marine conservation areas were recently created in the Southern California Bight (SCB). To assess the habitat and stocks of rockfish species in these areas, the SWFSC has developed a non-lethal surveying technique to use in cooperation with the Commercial Passenger Fishing Vessels (CPFV) fleet. The Collaborative Optical-Acoustic Survey Technique (COAST) combines the information obtainable CPFV captains, multi-frequency echo sounders mounted on CPFV and or NOAA vessels, and video and still cameras deployed from a remotely operated vehicle. Beginning with historical fishing maps, multi-frequency echosounders are used to map the potential habitat (e.g. deep rocky areas), and the rockfish dispersion and abundance within these strata; the video and still camera images are used to validate the acoustic classifications, and to quantify the relative numbers of each species and their sizes. Ultimately, the acoustically estimated rockfish abundance is apportioned to species using the optical data, and mapped.

### Discussion

Industry collaboration and two sampling methods are complementary.. Industry provides information about historical rockfish habitat, thereby optimizing the survey area. Optics deployed from a remotely operated vehicle (ROV) provide identifications of numerous rockfish species and estimates of their size distributions. Acoustics provide a nearly 320-fold improvement over the optical areal coverage, sample the entire water column and seafloor, and do not influence the demersal fish behaviours. The acoustics also provide a tool to observe fish reactions to the ROV. Fortuitously, rockfish were generally observed descending towards the seafloor where they could be better observed with optical sensors, while pelagic fish rose higher into the water column. Ultimately, rockfish densities were estimated and mapped by species by integrating echo energy, apportioning it to species using the optically-determined species mixture, and converting each portion to numbers of fish using the optical measures of fish sizes and a target strength model. Overall, the collaborative optically-assisted acoustic survey technique yielded results that were consistent with the most recent stock assessments that rely on no longer available fisheries dependent data.

A number of questions were raised. What level of identification could be achieved through multi-frequency acoustics? It was explained that remote identification based on sound scattering spectra may be successful with 4 – 5 categories of rockfish, but accurate identification of the roughly 42 species was very unlikely. It was emphasized, however, that the optical identifications were used to apportion the integrated acoustic energy to species. What is the cost of this kind of survey? Total cost was not known, but the use of fishing maps to constrain the area surveyed, and the combined use of acoustics and optics made the survey much more efficient than an optical or trawl survey. Could acoustics be used on the ROV to observe fish avoidance reactions? A scanning sonar is currently used and can observe fish near to the ROV. A 5-point laser system is currently used to measure fish lengths and their range from the ROV, but a stereo camera system is also planned to further improve the survey efficiency.

## 3.2 Juvenile Gadoid Abundance and Distribution on the Scotian Shelf based on Trawl, Acoustic and Video Techniques.

**John T. Anderson, Edgar L. Dalley, and Robert S. Gregory.**

*Northwest Atlantic Fisheries Centre, Department of Fisheries and Oceans, P. O. Box 5667, St. John's, Newfoundland, Canada, A1C 5X1, andersonjt@dfo-mpo.gc.ca, dalleye@dfo-mpo.gc.ca, gregoryr@dfo-mpo.gc.ca.*

Preferred (n=2) and non-preferred (n=2) habitat areas (100 km2) were identified on two fishing banks, eastern Scotian Shelf based on historical RV trawl data. Directed studies to measure fish abundance, distribution and behaviour were carried out in 2002 using a Campelen 1600 bottom trawl with rockhopper gear, a BioSonics DT-X 38 kHz split beam acoustic system and a purpose-built towed seabed video camera system. All data were restricted to within five meters of the seabed. Sampling was conducted in 1km by 5km study sites both day and night. The trawl catch rates (CPUE) were dominated by haddock (*Melanogrammus aeglefinus*) compared to Atlantic cod (*Gadus morhua*) in the preferred areas by ratios of 29-34:1. In the non-preferred areas haddock were only twice as abundant as cod. Haddock abundance was 16-18 times greater in preferred areas whereas Atlantic cod abundance was similar in both habitats. Acoustic and video based data (fish m-2) correctly estimated abundance among all four areas compared to the trawl. Day time trawl catch rates were higher whereas acoustic backscatter and video fish counts were lower. Dispersion indices estimated from acoustic and video data demonstrated fish were highly aggregated both day and night but more dispersed at night. Combined, these results indicate fish were close to the seabed during day time and dispersed up into the water column at night. Juvenile gadoids were distributed in direct relation to density at spatial scales that ranged from 10s to 1000s of meters. Acoustic and video systems were capable of demonstrating small scale associations of distribution with seabed habitats.

#### Discussion

It was noted that it was not always possible to distinguish between cod and haddock on video observations, although fish abundance was comparable to trawl abundance. The lower video abundance estimates during the day were thought to be possibly a combination of natural rising behaviour and avoidance of the ROV. The question of what was classified as day and night for this study was raised. Operations were carried out for 4 hours around midday and midnight to avoid dawn and dusk periods.

### 3.3 Acoustic and video remote sensing of deep water habitat for conservation of biodiversity and sustainable fishing management objectives.

**Rudy J. Kloser and Alan Williams**

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We have developed a combined acoustic and video remote sensing tool kit to characterise and monitor Australian deepwater habitats. For this purpose we use multi-beam swath mapping and sub-bottom profiling to characterise the bathymetric, substrate and substratum components of the seafloor. We use a towed stereo video camera to characterize benthic biota and communities and their multi-scale spatial relationships with seabed structure. Macrobenthic invertebrate biodiversity based on taxonomic, functional and morphometric types is estimated from benthic sled samples, while a sediment grab and rock dredge provides samples of substrata. Examples are provided from two locations where marine protected areas have been declared, being from a deep tropical continental shelf/slope and from temperate seamounts where conservation of biodiversity and sustainable fishing management objectives require characterisation and monitoring of the seafloor. In particular we evaluate the metrics derived from the acoustic and video systems, their spatial co-location and coverage to inform management objectives. At the seamount location we demonstrate that the deep water coral habitat has persisted despite intensive demersal fishing of orange roughy. The management objective of monitoring the impact of fishing and quantifying the recovery of the biota will be discussed.

#### Discussion

The use of historical information, in this case from commercial fishermen, was again highlighted as a first step to target efforts to the right areas. Accurate geo-location of data was also emphasised as crucial. Possible covariates for biodiversity considered included depth, backscatter, slope and hardness.

### 3.4 Estimating sea cucumber density on the seafloor using towed underwater cameras.

**Paul D. Winger[1], Chris Keats1, Lew Barrett[2], Don Stansbury[3], Elaine Hynick, and Scott Grant[1]**

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The sea cucumber *Cucumaria frondosa* (Echinodermata: Holothuroidea) is widely distributed throughout the waters of Newfoundland and Labrador as is currently harvested using a combination of dive and towed gear methods. A five-year resource assessment plan is currently underway for sea cucumber on St. Pierre Bank (NAFO Div. 3Ps) as part of DFO's New Emerging Fisheries Policy. Before commercial harvesting licenses can be issued for the harvesting of this population, reliable information on the abundance, growth, distribution, density, and habitat preference of the sea cucumber is required.

This study used a towed underwater camera system in investigate the habitat utilization and density of sea cucumber on St. Pierre Bank in August 2004 and 2005. Video footage of the seafloor was collected using a towed benthic sled. Sea cucumber density was estimated for 9 transects using common photogrammetric and line-transect (distance sampling) techniques.

We found that sea cucumber was easily identified by camera and that the tool had good potential for understanding the behavioural ecology of the species. Distribution of the sea cucumber was not uniform but rather random or patchy, in most cases. Animals were observed on a range of habitat types including sand, shell, gravel/cobble, and rocky bottom. Estimates of sea cucumber density were derived using line-transect (distance sampling) techniques. Densities were lowest on average for rocky bottom (0.22 m2, intermediate for sand and shell bottoms (0.34 m2 and 0.44 m2, respectively), and highest for gravel/cobble bottom (0.72 m2). The results indicate that sea cucumber is capable of colonizing different habitat types and that some habitats are preferred over others.

#### Discussion

The Canadian perspective grid was used to account for differences in likelihood of spotting targets in the centre and edges of the video. The probability of detection varied between habitats. The video approach was thought to be as effective as trawl methods with the advantage of added information on behavioural ecology and distribution. The use of cameras to make observations on the selectivity of trawl methods was also mentioned.

### 3.5 Where acoustics and trawls meet - using acoustics to shed light on catchability.

**Nils Olav Handegard[1], Kresimir Williams[2], and Chris Wilson[2]**

*[1]Institute of Marine Research, Bergen Norway, [2]NOAA, Alaska Fisheries Science Center nilsolav@imr.no*

Previous work on fish behaviour to a trawling vessel obtained by a split-beam echosounder buoy is presented in a catchability context, showing how individual fish trajectories are used to estimate the volume swept by a bottom trawl. Further, the use of sonar to quantify escapement from trawls has been investigated. A method to track single individual fish using a dual frequency identification sonar (DIDSON) was developed and tested on observations taken in midwater trawls. The automated process is evaluated using three test-data sets with different target sizes, observation ranges, and densities. The automated tracking algorithm was evaluated, using manually tracked test data as a validation standard. In the two data sets where the targets were smaller and less dense, the automated tracking performed well compared to the case where targets were dense and appeared large due to the shorter observation range. Target speed and direction, derived from the tracking data, showed good agreement between the manual and automatic methods for all three test cases.

### Discussion

A number of questions were raised including what was the resolution of the Didson images? (not known exactly) and whether there was any evidence to suggest that the fish could detect the sonar? No reactions were observed to suggest that this was the case. The possibility of using the Didson for studying cetacean interactions in pelagic trawls was also raised.

## 3.6 The CatchMeter - application of computer vision for fish species recognition, length measurement and weight determination.

**Darren White**

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The CatchMeter is a vision-based catch registration system capable of automatically determining the species, length and weight of fish. Fish pass along a conveyor system with a maximum speed of 1.5ms-1 and are analysed by computer as they pass underneath a video camera. The system can process roundfish and flatfish of 5cm to over 1m in length and can be trained to recognise new species as required. One system is currently installed on the Norwegian G.O. Sars research vessel and in a recent test using data from three cruises the CatchMeter classified 10909 fish of 13 species with an accuracy of 97.2%. The length measurement method was shown to give an average standard deviation of 1.8mm for 7140 fish and five species compared to careful manual measurements. Weight measurement has not yet been fully implemented but will be done using electronic graders and laser triangulation. The CatchMeter may be connected to sorting units to enable sorting of selected individual fish for recording of extended biological parameters. With the CatchMeter the sampling process is automated and the capacity for biological sampling will be increased with a reduced need for manpower for measurements and sorting. The new system is primarily intended for use on research vessels but it will also be of interest to commercial fishing vessels and at landing sites of fish processing plants.

### Discussion

There were a number of questions raised after this presentation about the discriminatory power of the system. Could the system distinguish between sub groups of a fish population, for example, coastal and offshore cod? It was thought that this was feasible, but with a lesser degree of certainty than between species discrimination. There was some concern that if the system encountered an unknown species, it might try and assign to something else? However, if there is not a complete match, the system will always opt for “don’t know”. Could the programme deal with upside down flatfish for example? Not a problem, these kinds of images can be included in the training images used. Which was the most important discriminator, colour or shape? Colour was deemed the most important, but optimum results obtained using both. A number of practical issues were also raised. Could the system operate in poor weather? It has been used successfully in seas with wave heights of up to 11m, so essentially, yes. A belt made of “course” material stops the fish sliding around. How fast could the system process fish? The belt speed is currently the main restriction, giving a capacity of up to 8,000 fish per hour, depending on size colour and shape of fish.

## 3.7 Using a laser stripe system to measure the physical impact of trawl components on the sea bed.

**Barry O’Neill[1], Keith Summerbell[1], Mike Breen[1] and Grant Thompson[2]**

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As we move towards an ecosystem based approach to fisheries management the need to consider the broader impacts of fishing gears has become more evident. In particular the impact of towed demersal gears on the seabed is under increased scrutiny. Concerns, regarding the extent to which towed gears contribute to benthic mortality, habitat destruction, resuspension of sediments etc have been raised. In this presentation we briefly outline the work taking place at FRS Marine Laboratory to develop methods to assess and quantify the impact towed demersal gears on the seabed. In particular, we show how we can profile the sea bed using a laser stripe system that can be positioned by divers. We examine the impact that a roller clump has on both fine sand and soft mud and that the doors, sweeps and groundgear of a demersal trawl have on fine sand.

#### Discussion

The comment was raised that what was observed may be subtly different to the initial impact, due to movement of sediment subsequent to impact.

### 3.8 SonarData's Data Fusion Project: Closely coupled visualization and analysis tools for 4D environmental data.

**Ian Higginbottom and Tim Pauly**

*SonarData Pty Ltd, 110 Murray Street, Hobart, Tasmania 7001, tim@sonardata.com*

SonarData's data fusion project and "Eon" software is designed to increase the 'bandwidth to brain' with a powerful combination data access, fusion, analysis and visualization that is not available in existing software such as GIS and Google Earth. It will allow information from one set of sensors, such as acoustic data, to be seen and analysed in context of other data types from the same area including bathymetric data, seabed type, video imagery, satellite temperature, drifter buoy observations and oceanographic parameters. A topology model deeply embedded in the design will allow relationships within and between data types to be explored quickly and easily. User developed code and links to external software such as "R" will facilitate analysis for advanced users. The core of the software is designed for multi-processor computing environments making it scalable and able to take advantage of coming generations of desk top computers. Advanced data models allow very large data sets to be handled.

We intend that Eon will enhance the excitement of discovery that visualization brings to data analysis, provide a suite of tools that makes the interesting fascinating and the mundane easy, and ultimately offer 'inter-ocular traumatic impact' - understanding that hits you right between the eyes.

#### Discussion

The issue of different data format restrictions was mentioned. Specific data formats are used and parsing routes available for advanced users.

## 4 Study Group Reports

### 4.1 Study group on Fisheries Optical Technology [SGFOT]

**Eirik Tenningen**

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The first meeting of the Study Group on Optical Technology was held on the 21st and 22nd of April at the Crowne Plaza Hotel, Dublin. There were 19 participants, mainly from FAST, but also including a number from FTFB. The aim of the Study Group is to produce a literature review of existing and emerging optical technologies for target identification, behavioural characterization, measurement uncertainty (e.g. catchability) as well as visualisation and management of optical data and automated data processing. Presentations were given on a variety of topics; video-based electronic monitoring for fisheries observing: automation of *Nephrops* counting: the use of under-water video cameras for observations of seal and salmon interactions in salmon traps: a DFO National Workshop on survey design, database design and analysis of underwater video/photographic surveys and airborne optics. The Group have produced an outline for an *ICES Cooperative Research Report* which will be circulated for comment. The report will describe the different technologies being used; the integration of these technologies including platforms, cables, electronics, software, synchronization and geo-location; document different methods of data processing and review the applications of the technologies considered.

The study group will meet in Bergen, Norway from 14-15 June 2008 to:

a ) Evaluate progress of the review of optical technology as agreed on the 2007 SGFOT meeting and finalise cooperative report structure
b ) Review the outcome of the recent relevant conferences (e.g. Oceans 2007)
c ) Discuss recommendations for future work within optical technology to service the ecosystem approach for fisheries management.

The group also proposed a number of recommendations:

A theme session "Optical and image based technologies for ecosystem approach to fisheries management" for the 2009 Annual Science Conference. Chairs: Eirik Tenningen (Norway) and William Michaels (USA)

The draft report structure is disseminated amongst relevant ICES expert groups for comments (e.g. WGFTFB, WGMHM, WGNEPH)

## 4.2 Study group on Fish Avoidance of Research Vessels (SGFARV)

**François Gerlotto**

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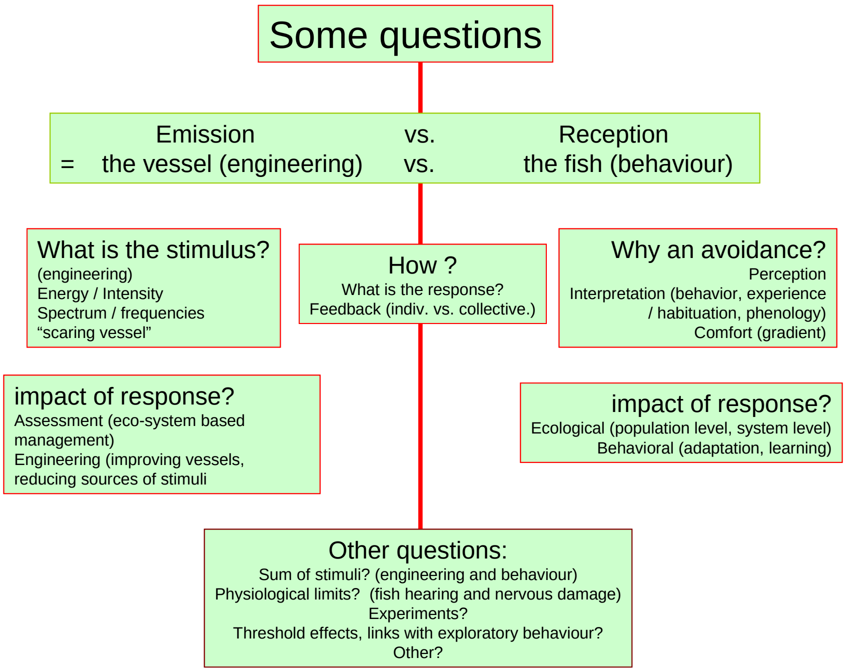
Fish avoidance of research vessels – an old question not yet elucidated. Two key elements of approaches to studying this topic are "Emission" - characterization of the vessel noise in the context of the background environment and "Reception" – the perceptual abilities and response behaviour of the fish under different conditions. Research in the 1980s and 1990s pointed to a simple stimulus and a straightforward avoidance reaction. The solution was to build noise-reduced vessels. Studies since then have produced varying and sometimes conflicting results which point to a far more complex process. What is the stimulus? Why do the fish respond as well as how do they respond? Finally, what is the impact of that response? The aim of the Study Group is to combine expertise from technical and behavioural backgrounds to work towards an improved interpretation of fish behaviour, characterization of vessel noise specification and recommendations for experimental studies required. The Study Group on Fish Avoidance of Research Vessels will hold its first meeting on the 28th and 29th April at the Crowne Plaza Hotel, Dublin.




# 5 Discussion Session

Four themes were apparent in the presentations given;

## 5.1 Different levels of Resolution.

Trawls, acoustic and video systems all have different resolutions and capabilities that are complimentary. Optical methods give high levels of detail often allowing species identification, individual length measurements and fine scale changes in habitat. Acoustic methods have a bigger footprint, reasonable resolution relative to optics and are necessary for whole water column studies. Physical sampling methods such as trawls capture the subjects, integrate large areas and allow reference to historical information. All have "dead zones", and all elicit avoidance reactions by fish and other biota. The strength is in combining these different tools for a greater resolution, over a wider area allowing a more holistic view of the eco-system.

## 5.2 Being in the right place, at the right time.

Integration of many different data collection metiers requires reliable, practical and accurate referencing in space and time. Geo-location and time synchronization are not a trivial jobs, but will be vitally important as we "increase bandwidth to the brain" (Sonardata, 2007). If accurate and reliable integration can be achieved then the potential rewards of visualization, exploration and analysis of these multiple data sets in a 4D computerized environment are enormous.

## 5.3 Avoiding the data bottleneck.

The primary tools for understanding fish behaviour remain optics and then acoustics, with multibeam, high frequency sonars such as the Didson at the interface. All produce high volumes of data that can be complex and difficult to analyse, especially video, particularly historic video. A very clear need exists for a range of effective image processing tools that allow analysis to be automated to some degree and reduce the data bottleneck. Ideally these applications would be simple, functional and cheap. However, the reality is that often such applications require specialized expertise and a large amount of development time.

### 5.4 A picture is worth a thousand sea cucumbers.

The value of video as a sampling tool was demonstrated with the TV survey that was able to provide straightforward visual evidence that, despite apparently high catch rates, the sea-bed was not “knee deep” with these animals, as suggested by those prosecuting the fishery. The novel use of a diver-positioned laser stripe system for accurately measuring the physical impact of trawl components on different substrates will allow input of fine scale information into models of the impact of trawling on the benthic community. In the face of increasing complexity there is still a role for simple, noncomplex hypothesis driven questions that can be answered with straightforward experiments and simple scoring of data.

### 5.5 Discussion points

The discussion started with a glimpse of possible future sampling methods including high frequency side-scan systems to observe fish entering trawls and open cod-ends where cameras and lasers are used to sample the fish. Perhaps there may be no need for nets at all if lasers can be used to herd fish towards sampling tool. With less need now to measure fish (manually), there is more scope to explore the types of tools described by Ian Higginbottom.

It was noted that we should take advantage of these new techniques for removing the dead zones of different sampling methods. However, bearing in mind that the aim is to estimate the volume density of fish, a return to echo counting could be considered.

The need to understand the impact of spatial scales was recognized. Many traditional strata for, trawl surveys for example, do not consider general habitat and fine scale fish population structures revealed by optical and acoustic techniques. At a smaller scale there may be a lack of fit between tow duration and the spatial structure in the area.

An understanding of fish behaviour is important for almost all aspects of this work; avoidance, catchability, function of trawls, acoustic abundance determination etc. Do we now have the tools to fully quantify catchability? There remains the need for basic, appropriate behavioural studies. However, it was pointed out that we need to differentiate between studies that quantify “fish reaction” and those that elucidate “fish behaviour”. The stochastic nature of the latter should be considered when we are asked to make predictions using biological modelling, but with the expected precision of physical models. Realistically, this is unlikely to be possible and should be made clear to stakeholders.

## 6 FTC Chair discussions

### 6.1 ICES Science Committee Restructure.

A presentation was given by Francois Gerlotto outlining the planned Restructuring of the Science and Advisory Committees to reflect a new way of thinking and create a new identity for the science system. The differences between Committees and Programmes were discussed and it was noted that generally, the approach is not understood by grass roots members, and the view was that the Consultative Committee document (Feb 2007) is a reasonable response. Whether the new structure would be more efficient was questioned and the point was emphasised that the most effective communication between groups is often achieved through individual participation in multiple groups.

### 6.2 Joint Session

There was a general consensus that the Joint Workshop had worked well this year. ICES encourages multi-disciplinary Committees, however, hosting both Working Groups together poses significant logistical difficulties. It was therefore suggested that an FTC mid-term session be held every year, taking the form of a full joint meeting every two years, and an EG

(Expert Group) chairs session at FAST or FTFB on alternate years. It was emphasised that meeting separately allows meetings to take place in locations where extra value is gained by the local science community from the meeting being held there e.g. Izmir and Hobart. Another suggestion was to hold meetings with other EG possibly in the interim years. As such, the next joint session was proposed for 2009.

### 6.3 FTC Organisation:

The organization, format and scope of FTC, FTFB and FAST and the balance between science and / or advice were discussed. Should FTC be re-named as "Marine and Fisheries Technology Committee". The flexible working approach with mini symposia, topic groups of 1-2 years and study groups of 3 years is deemed to be working well. FAST and FTFB are currently acting more like "sub-committees" than working groups and as such, there is no need for a new WG, as previously proposed, with new questions and topics being addressed inside the WG (= sub committees) through study groups and topic groups.

There was some concern expressed by FTFB members about the EU-centric nature of the work that prevents a non-European chair, and constrains the Working Group's ability to act as an FAO WG. The requirement to take on so much responsibility was questioned and it was pointed out that the WG Chairs should make it clear to ICES what cane be delivered and over what time scale. The feeling was expressed that the role of ICES should be to maintain the priority of scientific research since many other forums exist to deal with advice.

### 6.4 Election of a new FTC Chair

Nominations are welcome up until the Annual Science Programme. Since the current FTC Chair is from FAST, the next Chair should probably come from FTFB, as has become the custom. It was suggested that the new Chair should bring fresh ideas to the role in the framework of the ICES proposal for reforming science committees but should also be aware that FTC is likely to have to provide an increasing amount of advice.

## Annex 1: List of participants

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## Annex 2: Agenda

**Joint Workshop of the ICES-FAO Working Group on Fishing Technology and Fish Behaviour [WGFTFB] and the Working Group on Fisheries Acoustics Science and Technology [WGFAST] Meeting Agenda**

**Meeting Place: Crowne Plaza, Dublin Airport, Dublin, Ireland**

9:00 Welcome and housekeeping

9.10 Optically-assisted Acoustic Survey Technique (COAST) for surveying rockfish in the Southern California Bight. *David A. Demer, John L. Butler, Deanna R. Pinkard, and Ken Franke*

9:30 Juvenile gadoid abundance and distribution on the Scotian Shelf based on trawl, acoustic and video techniques. *John T. Anderson, Edgar L. Dalley, and Robert S. Gregory.*

9:50 Acoustic and video remote sensing of deep water habitat for conservation of biodiversity and sustainable fishing management objectives. *Rudy J. Kloser and Alan Williams.*

10:10 Estimating sea cucumber density on the seafloor using towed underwater cameras. *Paul D. Winger, Chris Keats, Lew Barrett, Don Stansbury, Elaine Hynick, and Scott Grant.*

10:30 Coffee Break

11:00 Where acoustics and trawls meet - using acoustics to shed light on catchability.*Nils Olav Handegard, Kresimir Williams, and Chris Wilson*

11:20 The CatchMeter - application of computer vision for fish species recognition, length measurement and weight determination. *Darren White*

11:40 Use of a laser stripe system to measure the impact of trawl components on the seabed. *Barry O'Neill, Keith Summerbell, Mike Breen and Grant Thompson*

11:50 Data fusion – seeing fish in the context of their environment. *Ian Higginbottom*

12:10 Report from Study Group on Fisheries Optical Technology [SGFOT]. *Eirik Tenningen*

12: 30 Study Group on Fish Avoidance of Research Vessels (SGFARV). *François Gerlotto and Julia Parrish*

Discussion

13:00 Lunch

14:00 ICES General Business - Report from FTC Chair

15:00 Meeting Close

# Annex 3: Recommendations

| Recommendation | Action |
|---|---|
| JFATB recommends that the WGFTFB and WGFAST meet jointly in Italy, in April 2009. The Terms of Reference are to be mutually decided by the Working Group Chairs and a designated joint session chair. | FTC, WGFTFB, WGFAST |